BAHRAIN

COUNTRY PROFILE

**IMPLEMENTATION OF AGENDA 21:
REVIEW OF PROGRESS MADE SINCE THE
UNITED NATIONS CONFERENCE ON
ENVIRONMENT AND DEVELOPMENT, 1992**

**Information Provided by the Government of Bahrain to the
United Nations Commission on Sustainable Development
Fifth Session
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United Nations Department for Policy Coordination and Sustainable Development
Division for Sustainable Development
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BAHRAIN

This country profile has been provided by:

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Date: 7 May 1997

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All statistics are rendered as provided by the respective Governments.

UNCSD - NATIONAL LEVEL COORDINATION STRUCTURE OF AGENDA 21 ACTIONS
(Fact Sheet)

BAHRAIN

1. Key National Sustainable Development Coordination Mechanism(s)/Council(s).

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2. Membership/Composition/Chairperson

2a. List of ministries and agencies involved:
Ministry of Health, Ministry of Commerce and Agriculture, Water Resources, Dept., Central Municipal Council, Ministry of Finance and National Economy, Ministry of Development and Industry, Ministry of Information, Ministry of Education, Bahrain Centre for Studies and Research (BCSR).

2b. Names of para-statal bodies and institutions involved, as well as participation of academic and private sectors:
Major companies, Bahrain University, Arabian Gulf University.

2c. Names of non-governmental organizations:
Professional Societies, Women Societies and Clubs.

3. Mandate role of above mechanism/council:

4. If available, attach a diagram (organization chart) showing national coordination structure and linkages between ministries:

Submitted by
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Ministry of Housing, Municipalities and Environment
Environmental Affairs

Country Report on the

ENVIRONMENTAL MANAGEMENT

of the Small Island Developing State of BAHRAIN

April 1997

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Introduction

As plans were being set up for the coming phases of Industrial, Economic, Health, Education and Social Developments in the Small Island Developing State of Bahrain, and in the light of augmenting Global concern, our Government has rapidly recognized that meaningful success on the above-mentioned developments cannot be realized unless the Environmental Management of the country be integrated in the process of development wheel to achieve the sustainable development at large as this is explicitly spelled out in the lately enacted Amiri decree-law No. 21 (1996) and subsequent upgrading the former Environmental Protection Committee into An agency under the Ministry of Housing, Municipalities and Environment.

This special report summarizes the experience of this Small Island Developing State in Environmental management that - includes but not restricted to-development of Environmental laws and guidelines, monitoring the environment , protected areas conservation and above all, it demonstrates the commitments of the Government in participating, and affirming the partnership relations with the International community and the Regional Nations (such as the League of Arab States and the Gulf Cooperation Council) their efforts and concerns on the protection of the Globe through the ratification of conventions and protocols, and the attendance of the conferences such as the Earth Summit of the United Nations Conference on Environment and Development (UNCED), took place in Rio de Janeiro in June 1992.

Post Rio, the Government of Bahrain participated actively in a similar conference but devoted to the Small Island Developing States convened in Barbados in 1994.

The 19th Special Session of the General Assembly of the United Nations which will be taking place on the period from 21 to 25 June 1997 to discuss the progress on the agenda 21, after 5 years, should take into consideration that what remains is urgently needed effective action, which is only possible with national determination together with sustained and incessant international efforts and cooperation.

Chapter One

General Information

The state of Bahrain is located centrally on the southern shores of the Arabian Gulf between latitudes 25° 32′ and 26° 30′ North, and longitude 50° 20′ and 50° 50′ East. It lies some 22 km off the Eastern Coast of Saudi Arabian and slightly further from the Western Coast of the Qatar peninsula. It is linked with Saudi Arabia through the King Fahad Causeway which has been opened in November 1986.

The state comprises a group of some 36 islands, with a total land area of about 700 sq. km. The largest of these is Bahrain where the capital city, Manama, is situated. Bahrain island accounts for nearly 85% of the total area of the State of Bahrain is low lying, with a maximum elevation of 134 metres. Apart from a narrow fertile strip along the North and North-Western Coast, it is generally rocky and bare. The limestone bedrock is covered with varying depths of sand which supports little vegetation other than a few tough desert plants.

Climate

The significant aspects of the general climate are cool winters with sparse rainfall, and hot summers with high humidity.

The winter season, from December to February, is influenced by low pressure systems from the Mediterranean, which travel east into the Gulf and cause periods of disturbed weather. These disturbances are accompanied by rainfall which averages approximately 74 mm per annum. January is usually the coolest month, when extreme low temperatures are experienced, and prevailing winds of north-westerly.

The summer season from June to September is generally hot with a noticeable increase in wet bulb temperatures. Initially the region is influenced by low pressure over Pakistan. This is caused dry north-westerly winds, known locally as ***Al-Barah***, to become established, they persist for long periods and create more pleasant conditions than in other summer months.

After this period, the low pressure system declines allowing the formation of South-Easterly winds known as the ***Kaus***, which cause a steady rise in both temperature and humidity.

August is the hottest month of the year when temperatures are at the highest level. By October, temperatures begin gradually to decrease and cloudiness increases bringing the possibility of rain. Although the weather may be changeable with the possibility of thunderstorms, the most comfortable months are March, April, October and November.

Settlements and Social Affairs

The total population reached over half a million in 1992. The Bahrainis represent about 62.5% of the total population, divided equally between males and females. A remarkable increase in the population has been noticed since 1971 when it was approximately half of the current population.

The growth rate of Bahrainis is 2.91% and the average age of the Bahrainis population is 18 and over. Therefore, Bahrain is classified as a young community. Those age between 15-44 represent 51% of the total population whereas the older people (65 years and over) represent 2.3% only.

Bahrain has a relatively high population density with 829 inhabitants per square kilometer. Due to its small size, the State experiences mixed development, industrial areas being located close to residential areas. The urban population represents about 80% of the total population.

The capital Manama, where most of the commercial centers, Government departments and other service centers are located. Manama has experienced some migration to the suburbs and other towns and areas. It is Government policy to provide housing in the various areas on the island since housing is a key element for socio economic development.
Increased urbanization[1] is sometimes coupled with the increase of domestic waste, and Bahrain's production of domestic waste 1.2 Kg per capita which is considered to be one of the highest in the world.
Bahrain society is considered an urban and settled society. No Bedouins or tribes are present among the populations communities.

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1 The Bahraini definition of urban is places or communities with a population of 2500 or more.

Although the State of Bahrain is composed of various islands, the majority of the population is in the main Island Bahrain. It is the center for most activities and public services. Muharraq, the second largest island lies north east of the main island. The third inhabited island is Sitra, east of Bahrain.

Due to the large increase in population, inhabited areas have expanded southwards to the desert and new towns have been established. The first was Isa Town, built in the sixties and Hamad Town, built in the late seventies-early eighties. A third town is presently being planned in the south east region. However the old housing areas have witnessed a variety of improvements.

Bahrain experienced a rapid growth in all kinds of infrastructure during the seventies and eighties, such as modern road networks including bridges now connect all areas in Bahrain. The telecommunication system is excellent, almost every house in Bahrain has a telephone set. Direct dialing, telex, fax, internet, and other facilities are available to most parts of the world, expansion and upgrading the Bahrain airport facilities and seaport services, and construction of luxuries hotels to boost tourism.

Among the most important infrastructure utilities is a sewage network which has covered almost all major towns. However, a considerable progress has been achieved to cover adequate domestic and industrial areas. Limited reuse of the tertiary treated sewage waters is in use for irrigation in restricted and controlled areas.

Health services in Bahrain started early in 1900's. Since then, the Government is working very hard to provide advance free medical care to all inhabitants of Bahrain. The Government has also adopted the World Health Organization goal to achieve "Health For All in the Year 2000".

As a result of the health development experienced by Bahrain, the expectation of life at birth for both sex rose dramatically from about 55 years in 1971 to 67 years in 1991.

Government expenditure on health is over 8.5% more than that contributed to public expenditure, with a revenue of approximately 6.7% of the expenditure.
The initial health service commence at the Health Centers. There are 22 Health Centers and Clinics, 4 Hospitals and 5 Maternity Hospitals. Cases

requiring additional care are brought to Salmanyia Medical center, the biggest hospital in Bahrain which is highly equipped and contains over 832 beds. The total number of beds in hospitals (Government and Private sectors) is not less than 1837.

The regular education in Bahrain started in 1919 when the first boys school was opened in Muharraq town. Nearly ten years later (in 1928), the first girls school was opened. In 1929 education was put under direct Government control represented by Ministry of Education.

The education in Bahrain is in three stages: Primary stage (6 years), Intermediate stage (3 years and Secondary stage (3 years).

Higher education is available for secondary school graduates and can be obtained through the Bahrain University, Arabian Gulf University and specialized Institutes.

The total number of students of all schools reached 120657 in 1993 distributed among 162 Government schools and 31 private schools.

The Economic Growth

Prior to the discovery of oil in the early thirties the economy was dependent on agriculture, the pearl industry and regional trading. The pearl industry flourished in the past because Bahrain was amongst the richest areas in pearls. Government revenues from the pearling industry were, to a large extent, based on nominal taxes and fees imposed on each pearling ship together with indirect taxes imposed in the form of custom duties on pearls exported.

Since the discovery of oil in 1932 Bahrain witnessed a variety of changes, and by the beginning of the seventies when it became an independent state, socio-economic restructuring occurred on a rapid pace, boosted by the growing production of oil and gas industry, increased prices in the world market particularly during 1973.

However, due to the oil prices fluctuation, it is unwise to depend solely on oil as a principal source of income, and as such, industrialization became one of the options along with an additional key feature of Bahrain's

economy which is the attraction of the international financial institutions, thereby making Bahrain an efficient financial center in the Middle East..

National Income

Oil production and refining contribute by 56.4% to state revenue. In the last few years the dependence on oil has decreased and revenue from the non-oil sectors is gradually increasing. However, revenue from oil will dominate for years to come.

The Following is the percentage share of economic sectors in Gross Domestic Product (GDP) for the Year 1993.

1.	Agriculture and Fisheries	01.0 %
2.	Mining and Quarrying	16.4 %
3.	Manufacturing	20.9 %
4.	Electricity and Water	02.0 %
5.	Construction	05.1 %
6.	Trade, Hotel and Restaurants	11.0 %
7.	Transport and Communication	10.5 %
8.	Financial Services and Real Estate	18.0 %
9.	Social and Personal Services	04.4 %
10.	Public Administration and Defense	18.7 %
	Less: Input Service Charge	(08.1 %)
	Gross Domestic Product	100.0 %

Bahrain exports oil and non-oil products, light industrial products, aluminum, vegetables and some food stuffs. Total exports reached 1713.4 million Bahraini Dinars (BD) in 1996.

Total imports, which include all necessary and complementary items, reached 1578.3 million BD in 1996. The total trade exchange was 3291.7 million BD in 1996 and the transit shipment was 26.6 million BD in the same year.

Chapter Two

Environmental Management

Industrialization combined with the population increase has brought major pressures on the land area of Bahrain. There has been a considerable reclamation of land from the sea which caused blocking of natural drainage channels killing date palm trees, effecting mangrove swamps and stopping the flow of natural springs. The rapid industrialization has brought stress on the environment and other natural resources. While the primary aim of the new economic policy is to accelerate industrial development, improve operational efficiency and competitiveness, enhance exports and induce greater foreign investments, inevitably it will have both positive and negative environmental consequences.

Government of Bahrain felt that economic development and sound environmental management are complimentary aspects of the same agenda and without adequate environmental protection, development will be undermined. With this view in mind, the most important legislation was set forth as Amiri Decree No. 7 in August 1980, which formed the Environmental Protection Committee (EPC) and the Environmental Protection Technical Secretariat (EPTS). The EPC was attached to the office of H.H. The Prime Minister through the office of H.E. The Minister of Health , Chairman of EPC. Recently, an Amiri decree-law No.21 (1996) was enacted with the establishment of an Environmental Affairs (EA), an agency under the Ministry of Housing, Municipalities and Environment . The EA consists of two Directorates; Directorate of Assessment and Planning(See Annex-I , for 1997 projects), and the Directorate of Environmental Control (See Annex-II for 1997 projects). The Amiri decree-law No. 21 (1996) outlined the *inter alia* responsibilities:

The mission in Article 1

Subject to the rules and provisions set forth in the relevant Laws, the provisions of this Law concerning the environment shall come into effect.
This Law aims to protect the environment from the polluting sources and factors, and put an end to its deterioration by drawing up the required plans and policies to preserve it from the harmful effects resulting from activities

causing damage to human health, agricultural crops, marine life and wildlife, other natural resources and the climate, and the implementation of such plans, policies, adopt all the appropriate procedures and arrangements to put an end to the deterioration of the environment, prevent or combat all types of environmental pollution and limit such pollution for the benefit of present and future generations through the realization of sustainable development objectives.

The mandate in Article 3

The Environmental Body shall undertake the issue of resolutions and instructions in all matters relating to the environment and be empowered to execute all the required authorities and powers, particularly the following:

1. To draw up plans, policies and to supervise their implementation or the purpose of accomplishing its objectives.

2. To participate in drawing up the scientific research policy relating to the environment in co-ordination with the relevant authorities.

3. To have the right to request details which it deems essential, from any authority undertaking an activity which may lead to pollution or environmental deterioration.

4. To review contracts and agreements which define rights of the environmental body or result in obligations towards the said Body.

5. Other powers and duties provided for in this Law.

The objectives in Article 4

For the purpose of implementing its objectives, the Environmental Body shall co-operate and co-ordinate will all the relevant authorities to carry out the following:

1. To prepare drafts of laws, legislation and to issue regulations which ensure the safety, protection and development of the environment.

2. To discuss, study and propose general plans and policies for the environmental affairs on the State level.

3. To review, discuss and propose plans and policies drawn up by the Ministries, organizations, establishments or companies which are engaged in an activity that may harm the environment, propose answers for any environmental problems or obstacles that may face such programs and projects.

4. To discuss, study and prepare proposals and answers for any matters or problems related to the environment referred by the Council of Ministers, any other official or non-official party in the State.

5. To conduct or supervise comprehensive research work or studies about pollution, observe its negative effects on health and the environment, and adopt all preventative measures and possible required methods to limit the environmental pollution of all kinds and prevent environmental deterioration.

6. To lay down the required bases to link the environmental considerations with the planning and development policies on the State level through the introduction of the environmental management concept as an integral part of the defined policy for planning, implementing and follow-up of development projects which the government agencies or private sectors are executing through evaluating the environmental impact of such projects.

7. To exercise control over public and private activities which have a negative effect on the environment.

8. To study the nature of soil, water, power and to propose the means to preserve them from deterioration and reduction in quantity through the required regulations to limit their misuse or depletion.

9. To study the nature of the coastal areas and marine environment and to propose the protection of their resources, develop and promote them.

10. To lay down and promote preventive measures to limit the marine pollution from oil, other harmful materials and activities; to develop and train manpower to carry out plans for combating such pollution.

11. To establish an environmental reference laboratory and to provide it with the technical personnel, and required equipment for its operation.

12. To decide and control the measures and limits permitted for the emission of materials causing pollution of the environment and their concentration levels.

13. To seek to develop interest in educational, information, social and cultural aspects to increase and further develop the environmental awareness to enable the society to take an effective part in accomplishing the desired objectives for protecting and developing the environment.

14. To drawing and carry out the required programs to train and qualify the technical personnel in the field of the environment.

15. To conduct a comprehensive survey of the human settlement problems, monitor the development effects of economic and social conditions on the human settlements and their effect on the environment, propose the programs which provide suitable solutions and to implement them.

16. To establish schemes and systems for the collection and analysis of data and information, exchange them and benefit from the research institutes, specialized organizations and societies in the field of environmental affairs whether inside the State or abroad.

17. To review the international, regional and Pan-Arab agreements concerned with environmental affairs, and to express views with respect to joining them in co-ordination with the relevant authority.

18. To co-ordinate with the relevant authorities concerning the relations of the State with International, Regional and Arab organizations concerned with environmental affairs.

19. To determine the standards relating to the import and dealing in chemical and radioactive materials and to supervise their implementation.

20. To lay down the required bases for the proper management of industrial, health and domestic waste.

21. To seek to achieve co-ordination on both regional and international levels for ensuring the safety, protection and development of the environment.

Other legislation that relate to protection of environment have been issued as a series of Ministerial orders to control various disciplines (Table 1)

Table 1

Year	Subject
1977	To control the removal of the desert sand
1977	To control garbage collection
1980	To control the extraction of the ground water
1981	To control fishing
1983	To control agriculture
1984	To control importation of plant materials
1984	To protect date palm trees
1986	To protect dugong
1986	To control gill nets and shrimp nets
1986	To limit trawling to areas greater than 20m depth
1986	To prohibit use of drift nets
1989	To control the use of pesticides
1995	Protection of Tubli Bay (Mangrove protected area)
1996	Designation Hawar islands and the adjacent waters as protected areas

In addition to the above, national effluent guidelines have been formulated on the basis of standard practices followed in the region and are from certain existing standards of an implementation nature (Annex-III). However, a comprehensive review of the standards and guidelines of other countries, USýEPA, EU, Singapore, Hong Kong, Japan, and the Saudi Arabian MEPA, is in progress. It is intended after this study that the EA will formulate a compromise guideline.

Air Quality Management

Air Monitoring

Continuous monitoring of atmospheric pollutants at four geographical locations started from August 1993.

Pollutants such as Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Nitrous Oxide (NO), Ozone (O_3), Carbon Monoxide (CO), Hydrogen Sulfide (H_2S), hydrocarbons (HC), Inhalable Particulates (PM10) and Fluoride (F) are monitored. Recorded data at each station is transmitted via modems to a central computer system. Various mean values are automatically calculated and compared to acceptable ambient air quality standards. All measured values are available for statistical evaluation. Daily, weekly, monthly and annual reports are utilized in the decision making process.

Pollution by Motor Vehicles

There is a continuous increase in the number of cars in addition to those entering Bahrain from neighboring countries through King Fahad Causeway.

There were 169318 vehicles registered in use in 1995, which makes a car for every 3 persons living in this country. There is a joint effort to implement an action plan to reduce car emissions and introduce unleaded petrol, in coordination with the Directorate of Traffic and licensing and the Bahrain National Oil Company (BANOCO).

A program called "Fume watch" was introduced in Bahrain in 1994, to report vehicles, emitting smoke, followed by an immediate approach to rectify the situations in progress and resulted in noticeable improvement.

Water Resources Management. (Fresh water and Marine Water)

Marine Pollution Control

Great attention is paid to prevent marine pollution by controlling land based sources of pollution. There are marine monitoring programs (since 1983) to check the status of the marine life. Sea water, sediments, and fish samples are analyzed to determine nutrients, heavy metals, chlorinated pesticides, organic matter and hydrocarbons in order to preserve the health of the sea.

An effluent guidelines to control and prevent pollutants from industrial effluents that may harm the marine environment was developed and enforced.
Other tools to control discharge of pollutants into the marine environment are through the regional protocols that Bahrain had signed and ratified such as Protocol for the protection of the marine environment against pollution from land based sources, and Protocol concerning marine pollution resulting from exploration and exploitation of the continental shelf(Amiri decree No.9 for 1990).

Marine Habitat Survey

Using Landsat-V a study was conducted to determine marine ecology in Bahrain's coastal water. This study of 312 sites mapped the ecology of all the shorelines and coastal areas. The final product of this study was a set of 17 maps depicting the distribution of marine habitats, coastal ecology and areas recommended for protection. Also a comprehensive volume describing the habitats of the marine environment including the physical, chemical and biological influences. After the elapse of 10 years, the survey will be repeated, in June 1997, to determine the changes that might occurred to the habitats cover.

Regulate marine dredging and land reclamation activities

Recognizing the need to expand horizontally, it was realized that proper management and control is needed to regulate the coastal activities in order to minimize the adverse effects of dredging and land reclamation on the marine environment. Hence, in coordination with other relevant Governmental authorities, an assessment of the impact of dredging and land reclamation on the environment was undertaken. Appropriate alternative approaches concerning environmentally sound management of such activities had been formulated through the involvement of all authorities concerned with process and impact of reclamation and land dredging to ensure sound decisions and reduced impacts.

Sustainable Fisheries Development

Fish catch had been reduced due to the increase on fishing efforts (both the number of boats and fishermen) , in addition to indiscriminate land reclamation and excavation activities and destruction of coral reefs. An artificial reef development program has been undertaken by the

Fisheries Directorate and has paid well. They have succeeded in breeding juvenile fish in these reefs.
A commercial pilot project is underway to keep artificial reefs in various areas. This could enhance the marine ecosystems in a manner that maintains productivity and preservation for future generations.

Water Resources Management

Groundwater resources are depleting due to increased abstraction some times more than the recharge. Directorate of Water Resources under the Ministry of Works and Agriculture is making every effort to control excess water use. An Amiri Decree has been enacted stopping the drilling of new wells and control of the water use for agriculture is done by introducing drip irrigation practices. Re-use of waste water is practiced for municipal gardens, hedges and for fodder crops. Artificial recharge of treated water is being studied.
Water distribution network is being modernized and the latest state of the art equipment is being installed with a view to control excess waste by leakage and a tariff system is in use to control household demands.

National Sewerage network

Nearly 65 % of the total residential areas and part of the industrial areas of Bahrain is connected to the sewerage network and is anticipated to cover 90 % of the population by 2010. There are 12 sewage treatment units in Bahrain.

The largest unit is the sewage treatment plant at Tubli, which discharges treated water (actual capacity) at the rate of 160000 m^3 per day though the designed capacity is 124000.

Oil Spill Contingency Plan

Oil spillage is a recurrent phenomenon not only in Bahrain territorial waters but wide spread in many parts of the Arabian Gulf. A National Contingency Plan has been enforced since February 1993.

Land Management

Land use plan

Bahrain has formulated a land use plan for the year 2000 and beyond. There is a clear management policy in allocating land for industries, housing development, oil and gas processing, recreational and cultural activities, agriculture, public utilities, communications, ports and airports, road network and quarry activities.

Land Pollution Control

Land is being protected by preventing indiscriminate waste dumping throughout Bahrain. Agricultural development has adopted a policy on the use of agricultural chemicals (fertilizers and pesticides) that is governed by the international regulations on the safe use depending on their chemical, natural and biological properties to curb environmental pollution and control its impact. Bahrain is working toward enlarging the arable area, upgrade productivity, optimize utilization of available water resources and increase yield per hectare through soil conservation. There are projects for land reclamation, development of land drainage schemes, desertification control and organic fertilizer use.

Management of Industrial and Domestic Wastes

The disposal of industrial and domestic waste can be regarded as the most pronounced environmental problems in Bahrain. The generation of both types of wastes is relatively high (Table 2).

Table 2: Amount of waste by categories generated in tones in 1996 (source: Municipalities Affairs, 1997)

Type	Amount
Domestic	213758
Commercial	66254.31
Construction waste	28558.2
Agriculture	8642.22
Industrial non-hazardous	3388.24
Industrial hazardous	24000
Carcasses	6386.93
Grand Total	350987.9

The EA has quantified and analyzed the wastes, and it is concurrently studying the appropriate means to tackle the waste problems. The EA has been participating in several international and regional meetings to discuss protocols and to formulate a unified system for waste management in compliance with the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal.

Currently domestic waste is land filled without any treatment at the site that is away from urban areas. Waste management practices had been improved especially the handling, collection and transportation. Landfill site is regularly monitored to control risk associated with it and to protect the health of the citizens.

Waste Separation and Recycling

There are many small companies involved in collection and segregation of waste paper, car batteries, glass, plastic, aluminum cans, metals, and wood. Some of these wastes like aluminum are being recycled in Bahrain. These activities have reduced the amount of waste that needs to be incinerated or put in landfill. Oily waste and lubricants from automobiles is collected and exported.

Managing of Chemicals

World-wide, millions of chemical compounds have been manufactured and few thousands more are added every year. However, several events, internationally and regionally, indicated that chemicals could be a threat to the human health and the environment. Bahrain, with no exception, utilizes large volumes of chemical compounds and materials that is based on some potential chemicals that may threat the human health and the environment. Hence, a joint effort between relevant authorities lead to sound procedures dealing with the safe handling and disposal of chemicals including those of toxic, hazardous and radioactive nature. There is a close follow-up and coordination between all authorities concerned with chemical production,

transport, recycling, treatment, storage, and finally disposal to ensure sound management of such potentially harmful product.

Environmental Public Awareness (EPA) program

Great attention is given to the importance of EPA to the public and decision-making levels and encourage their participation wherever appropriate.
EA cooperates with other Ministries and NGOs such as private schools and societies in executing all specialized programs focused on increasing public awareness in regard to national regional and international environmental issues. These programs include - but not restricted to - painting and drawing competitions among students, stage show, lectures at school, TV interviews, scientific field trips, etc.

EA in coordination with relevant public and private sectors celebrates the following events to engender a concern and caring attitude.

- 7th April- World Health Day.
- 22nd April - Earth Day.
- 24th April - Regional Environment Day.
- 5th June - World Environment Day.
- 14th October - Arab Environment Day.

Environmental Education

EA is collaborating with the Ministry of Education on regular introduction of environmental topics, literature and issues of national, regional and international nature in the school curriculum. Every attempt is made to develop an earth watching, earth-protecting, earth-caring, and earth-helping attitude in the minds of children. Many schools have been encouraged to start recycling activities and leading schools have already started Ecology clubs. Children regularly take part in clean-up campaigns and project work on environment. On World Environment day, 1992, EA supported NGO's in organizing a "Mini Earth Summit" in Bahrain. The conference was a big hit and was not only a learning experience for the participating students, but also received attention in community.

EA jointly with Central Municipal Council (CMC) and the Directorate of Heritage and Museum celebrated the Environmental occasion by a 3 year carnival entitled, 'Who adopts a Palm Tree' in which a date palm seedling had been distributed among the children to plant them in their gardens and to take care of it.

Training and Development of Human Resources

A considerable attention to train general and professional staff either by supporting or encouraging them to pursue their academic studies, participate in workshops, technical conferences, seminars and specialized training courses is a continuous process to achieve the ultimate goal in making EA a learning institute.

Sustainable Development in Industrial Management

Pollution Prevention (Cleaner Production Technology)

It is well known that cleaner production and zero waste technology hold tremendous promise for the alleviation of many problems associated with industrialization. EA is taking a proactive step to spread this approach in industry and it stands now as one of our major activities.

Like other developing countries, Bahrain faces obstacles in the implementation of new technology due to lack of immediate transfer of technology from developed countries and due to lack of experience. Some regulatory means are introduced as part of EIA process and training is imparted in this field for staff abroad. Cleaner Production concept was introduced in Aluminium Bahrain (Aluminum reduction plant) at a cost of Bahrain Dinars (BD) 95 Million and is also being introduced in an integrated Iron and Steel plant and other metal processing industries. While the EA seriously consider the introduction of the Environmental Management and ISO 14000 as future target, many industries have been awarded ISO 9000 series certification showing their commitment for achieving quality production.

Risk Control Measures

The EA in cooperation and coordination with concerned authorities and major companies are finalizing a plan of action to combat industrial accidents. The plan is based on Awareness and Preparedness of Emergencies at the Local Level (APELL) manual and some scenarios planned by some major industries.

Realizing the importance of the generalization of the APELL manual, originally prepared by UNEP/Environment and Industry Office, EA took the initiative to translate and print the manual in Arabic and distributed to all Arab Countries and specialized institutions.

Environmental Impact Assessment (EIA)

Bahrain is committed to the cause of environmental protection and has thus decided to incorporate Environmental Impact Assessment (EIA) into the industrialization process to solve the problems of pollution and environmental degradation.

EA and The Ministry of Oil and Industry (MoOI) have "A Memorandum of Understanding" which gives a flexible system in fulfilling the objectives of both, taking into accounts promoting the industrial investment and the needed balance between the industry and the environment.

Conservation

A number of activities are usually undertaken to involve public participation in EA programs. Many sub-committees and ad-hoc committees are formed to enable other professionals and public to effectively participate in activities or formulate programs that would enhance the environmental management decision making process in Bahrain.

Wildlife

A wildlife sanctuary "Al Areen" was established on 1976 and has been managed through H.H. The Crown Prince Court. A successful breeding in

captivity and cross fostering program for some endangered species have been achieved.

Realizing effective management of flora and fauna depends upon the maintenance of their habitats and control of their rational utilization, a National Committee for the Protection of Wildlife attached to H.H. The Crown Prince Court, was formed with a mandate of protecting the wildlife in coordination with all relevant authorities.

Mangrove Swamps

EA aiming to develop the 43 hectares of mangrove swamp into a wetland conservation area. There are plans for a museum, walkways, bird watch towers ultimately aiming to convert it in to a tourist spot.
The development will allow public to experience and enjoy the natural history of Bahrain's coastline.

Coastal Zone Management

Several studies conducted locally had confirmed that reclamation and coastal activities had adversely affected the intertidal habitats, and mangroves were also found on the verge of destruction. An integrated coastal zone management approach was identified and adopted as the most effective mechanism that could manage the marine environment and achieve sustainability. A procedure for identifying, minimizing, and mitigating the negative consequences of the development of the coastal environment has been set with the help of UNDP.

Sensitive Natural Areas

Based on program identifying the degree of sensitivity of Bahrain coastal areas. The following areas have been categorised:

1. Full Protection:
   - Hawar Islands.
   - Mashtan Island and Surrounding Reef Area.
   - Western and Southern Coastline of Tubli Bay.

These areas are considered to be birds feeding and roosting zone so they need to be fully protected.

2. Conservation Status :
   - East Coast Reef and Seagrass Zone.
   - Northern Edge of Fasht Adhm.
   - Inner, Northern and Eastern Tubli Bay.
   - The Outer Reefs, Jarada and Fasht Dibal.

These areas represent zones of major commercial and scientific importance due to the presence of number of unique and rare habitat types namely, coral reefs and seagrass beds, the reefs are of importance because of the rich diversity of marine life, while the seagrass beds are an important habitat for commercial species of fish and shrimp as well as endangered species such as turtles and dugong. So those area require some measure of conservation, monitoring and general supervision.

3. Seasonal Management Status:
   - South Western Coastal strip of main islands.
   - East Coastal strip - Sitra to Askar.
   - Island Nesting sites.

These are mainly nesting or migratory feeding sites for sea birds: due to variety of factors including development of coastal strip, disturbance by man, ... ext. recommended to be given some seasonal protection and management to prevent such interference.

Cooperation with National, Regional and International Organizations

EA has strengthened its relation with Governmental and non-Governmental organizations in order to facilitate executing its assignments. It has maintained its distinguished and goodwill ties with many establishments and companies from the private sector including non-governmental societies.

At the regional and international levels, the EA has participated more actively and effectively in many aspects to strengthen the coordination and cooperation with specialized national institutions of many countries for the implementation of joint projects, exchange of expertise and data transfer.

Regional Co-operation

The eight coastal States of the region(Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the UAE) have coordinated a common action to protect the Arabian Gulf and Gulf of Oman. Consequently ROPME was established on 24 th April 1978 to be the governing body to fulfill this goal. Several protocols have been adopted to facilitate coordination between member states to implement the regional programs and activities. Accordingly, Bahrain has signed and ratified the following protocols:

- Kuwait Regional convention for the co-operation on the protection of marine environment from pollution. Signed in Kuwait on 23rd April, 1978 and ratified on 1 April, 1979.

- Protocol concerning regional cooperation in combating pollution by oil and other harmful substances in case of emergency, Kuwait on 23rd April, 1978 and ratified on 1 April, 1979.

- Protocol for the protection of the marine environment against pollution from land based sources, Kuwait, 21st February, 1989 and ratified on 16 May, 1990

- Protocol concerning marine pollution resulting from exploration and exploitation of the continental shelf, Kuwait 29th March, 1989 and ratified on 16 May, 1990.

On the other hand the head of States of the Gulf Cooperative Council (GCC) had adopted in 1985 the general principles on the protection of the environment in the region to form the basic guidelines and Code of Conduct towards the individual and collective programs and activities in the various disciplines of the environment.

Several guidelines had been adopted such as the unified guidelines for Environmental Legislation and Environmental Impact Assessment.

Agenda 21

The State of Bahrain is one of many countries that participate in support the United Nations Conference on Environment and Development (UNCED), that was held in Rio de Janeiro- Brazil in June 1992, which asserts the necessity of linking sustainable development with the

conservation of environment. And for the sake of executing Rio de Janeiro declaration, the Environmental Affairs (EA) insisted on the effective participation of all related parties in the State of Bahrain for the execution of Agenda 21.

A national committee was formulated to prepare a national strategy to execute Agenda 21 program. Many meetings were held to define the priorities, and five environmental issues were recognized, and considered to be pressing environmental matters. These issues are :

1. Protection of freshwater resources (Chapter 18).
2. Environmentally sound management of waste and chemicals (chapters 19,20,21,22).
3. Protection of the marine environment (chapter 17).
4. Protection of the atmosphere (chapter 9).
5. Changing consumption patterns (chapter 4).

In order to facilitate the proceedings of the above committees, it was requested from all ministries, companies, occupational organizations, and women societies to nominate a representative to participate in these committees. A coordinator from Environmental Affairs was appointed for each committee.

A. Protection of Freshwater Resources Committee:

This committee consisted of a chairman representing the Arabian Gulf University and members representing Ministry of Oil and Industry, Bahrain Petroleum Company (BAPCO), Aluminum Bahrain (Alba), Ministry of Works and Agriculture, Directorate of Water Distribution, Bahrain Center for Studies and Research (BCSR), Municipalities Affairs, and Bahrain Girl Renaissance Society.

The main tasks of this committee were:

1. To define and evaluate freshwater resources.
2. To protect freshwater quality, ecosystems and prevent underground water pollution.
3. To integrate development and management of water resources.
4. To study climate change effects on water resources.

An action plan was prepared included revision of the available studies in this field and the general policies related to water resources management, awareness programs to rationalization of water consumption. It was agreed that a mechanism for supporting and monitoring the comprehensive national strategy on water resources, that has been submitted by BCSR, is required.

B. Environmentally Sound Management of Waste and Chemicals:

This committee consisted of a chairman representing the Ministry of Oil and Industry, and members representing Bahrain Aluminum Extrusion Company (BALEXCO), Al-Zamil Coating Factory, Bahrain Aluminum (Alba), Environmental Health Directorate, Bahrain Chemical Society, Ministry of Commerce, and Bahrain Center for Studies and Research.

The main tasks of this committee were:

1. To prepare a mechanism to control the industrial chemicals and the daily usage.
2. To assist the national abilities through the suggestion of proper legal mechanism and to increase the awareness in controlling waste and chemicals.
3. To prepare a documentary system for the packing and storage of chemicals.
4. To prepare a mechanism to prevent the Transboundary transportation of hazardous waste .
5. To suggest effective procedures to encourage the reduction of waste through recycling.
6. To study a proper location for the disposal of industrial waste.
7. To study of the choice of regional treatment of waste.
8. To suggest a mechanism to disseminate the available studies in the field of waste and chemical materials.

Municipalities Affairs have introduced a strategy for treatment of solid waste which is currently under study and evaluation.

C. Protection of Marine Environment:

This committee consisted of a chairman representing the National Committee for the Protection of Wildlife and members representing

Directorate of Fisheries, Bahrain Center for Studies and Research, University of Bahrain, Ministry of Housing, Municipalities and Environment, Ministry of Education, Bahrain National History Society.

The main tasks of this committee were:

1. To prepare guideline plans to protect coastal zones specially those which are economically important.
2. To prepare an action plan to protect marine resources specially those which are nationally and internationally important.
3. To study the climate change effects on coastal zones.
4. To prepare a plan to encourage Research related to marine environment and effecting factors.

A preliminary report was prepared that included a guideline for preparation an action plan to protect the coastal environment which is under study and evaluation process.

D. Protection of the Atmosphere:

This committee consisted of a chairman representing Bahrain Center for Studies and Research, and members representing Ministry of Health, University of Bahrain, Ministry of Oil and Industry, Ministry of Works and Agriculture, Meteorological Office , Directorate of Electricity, Public Transportation Organization and Bahrain Medical Society.

The main tasks of this committee were:

1. To prepare a database about the atmosphere to support decision makers.
2. To prepare a strategy for protecting ozone.
3. To suggest a procedure to protect the environment from the transboundary movement of pollutants.
4. To determine pollution effects on health from stationary sources.
5. To suggest an action plan to protect the atmosphere.

It is worth to mention that Environmental Affairs have started air monitoring program consisting of four air monitoring stations, and the monitoring results were disseminated to the concerned bodies in the state of Bahrain.

E. Changing Consumption Patterns:

This committee consisted of a chairman representing Bahrain Chamber of Commerce and Industry and members representing Ministry of Cabinet Affairs and Information, Bahrain Center for Studies and Research, Ministry of Education, Bahrain Girl Renaissance Society and Bahrain Society of Economist.

The main tasks of this committee were:

1. To participate in suggesting program and policies to encourage changing consumption pattern.
2. To define the effects of unrational consumption on the economy growth.
3. To encourage consumption patterns and development in a way to minimize the environmental overstrains.
4. To develop a better understanding of the consumption role and pinpoint more sustainable consumption patterns.
5. To participate in evaluation of the relation between production, consumption and environment, and studying the effects of current changes in the status of modern industrial economies on the environment.

The Environmental Affairs is continuing reviewing the performance of these committees for suggesting new mechanism for follow-up.

Generally, the ambition of the committees is too great as stated by Agenda 21 and the Achievements of these committees should be subjected to rational consideration. The ambitions won't be a real without the international co-operation through the related organization, specially United Nation Environment Program, United Nation Development Program, Economic Social for West Asia (ESCWA) and Sustainable Development Committee.

International Conventions and Protocols

Recognizing the need for appropriate legal tools to affirm the commitment of the State of Bahrain towards the international community and the joint effort to protect the environment and achieve sustainable development, Bahrain has signed, ratified and acceded to a number of international

treaties and conventions that deal specifically with environment or have environmental implications.

Vienna Convention for the Protection of the Ozone layer and the Montreal Protocol on Substances that Deplete the Ozone Layer

Bahrain supports the endeavor of the International community to reduce the consumption of fully halogenated CFCs and Halons. Bahrain signed the Montreal Protocol and expressed its firm commitment to strengthen ozone layer protection by ratifying the Montreal Protocol on 27th April 1990 and the London amendment on 23rd December 1992. Bahrain's per capita consumption is <0.3 kg and is categorized as a developing country operating under Article-5 of the Protocol.
Here below is the progress made , so far, by the EA and the National Ozone Team;

I. January 1997 : Submission of the budget breakdown and Time Schedule of project activities for the institution strengthening project.

II. February 1997: Preparation of Recovery/Recycling of Refrigerants Project with the help of UNDP Consultants.

III. February - March 1997 : Questionnaires were sent to Governmental and Public Sectors who use Refrigerant (R-12).

IV. March 1997 : Return of the UNDP Consultant for data analysis to finalize the project for submission to MLF, for discussion.

V. April 1997 : First Cash Advance Statement was sent to MLF for first Payment of Institutional Strengthening Project.

Climate Change Convention

Bahrain signed the frame work convention on climate change in Brazil in June 1992. A sub-committee has been formed to study and formulate a country action plan to combat the threat to global warming and to promote sustainable development.

Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal

It is of particular interest to mention that the State of Bahrain had ratified Basel Convention in 1992 which came into force in 1993.
The Regional Organization for the Protection of the Marine Environment (ROPME) is in the process of finalizing a regional protocol complementing Basel Convention on the transboundary movement of hazardous wastes across borders and the Gulf Cooperating Council (GCC) countries also working on a unified rules to deal with industrial waste.

International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969.

International Convention on the Establishment of An International Fund for Compensation for Oil Pollution Damage (FC), 1971

An Amiri Decree No. 13, 1995 was issued on 3rd May 1996 to accede CLC 1996 and its protocols of 1976 and 1992, and FC 1971 and its protocols of 1976 and 1992. CLC 1969 and its protocol 1976 and Fund 1971 and its protocol 1976 entered into force for Bahrain on 1st August 1996, whereas protocols 1992 for both Conventions (CLC & FC) entered into force for Bahrain on the 3rd of May 1997.

CLC forms the basic structure on which the regimes of liability and compensation for Oil Pollution Damage from ships are based, and the aim or function of the Fund Convention is to provide supplementary compensation to those who cannot obtain full and adequate compensation for Oil Pollution damage under the CLC.

Biodiversity Convention

Conservation of biological diversity constitute one of the most pressing issues of our time. In an attempt to address environmental problems in an international context, Bahrain signed the Biodiversity convention in Brazil on 9th June 1992. An Amiri decree-law No. 18 (1996) stated that the convention has been ratified on 19th June 1996.

Ramsar Convention

An Amiri decree No. 3 (1997) gives that the convention has been ratified on 26th February 1997. Attempts are made to ensure that wildlife and other national resources are protected and managed in harmony with other forms of development.

United Nations Convention To Combat Desertification (CCD)

In addition to the above conventions, Bahrain is considering signing the United Nations Convention to Combat Desertification (CCD). The State of Bahrain In cooperation with Gulf Cooperation Council, Islamic Bank for Development, UNEP/ROWA and Arabian Gulf University organized a Symposium dealing with the desertification and land reclamation in The GCC countries (22-25 Nov., 1993). Also, GCC-CCD convened meeting on the Convention to Combat Desertification for Environment and Agriculture Decision makers of the GCC member States (19-20 Nov., 1995).

In addition to the above conventions, Bahrain is a party in the following:

1. UN Convention on the Law of the sea signed in 1982.

2. International Convention for the prevention of pollution of the sea by oil, Geneva, 1958. Bahrain signed in 1985.

Chapter Three

Environmental Status

Air Quality

Air pollution concentrations vary in different time and place . The main pollutants are monitored continuously in order to meet the objective of air pollution management and control strategies. In order to assess the potential impact of the various air pollutants on human health and environment, it is necessary to have reliable information regarding pollution sources and their location. However, since many of the pollutants are invisible their presence must be detected using especially designed equipment. Thus, air quality monitoring programs are of fundamental importance in determining the air pollution, its sources, and provide the best prevention method.

EA, operates and maintains four automatic air quality monitoring stations around Bahrain. These sites are located at Manama, Askar, BATELCO earth station (Ras Abu Jarjur)and Zallaq (see map).

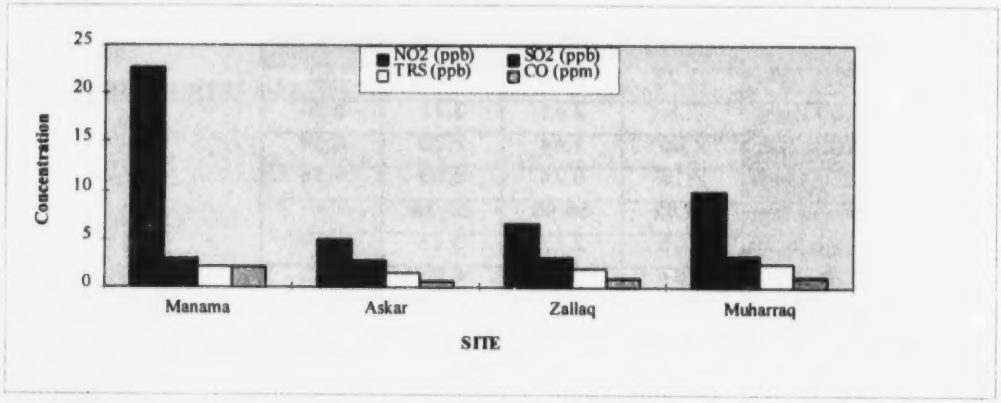
The parameters monitored are Sulfur dioxide, Total reduce sulfur, Nitrogen oxides, Carbon monoxide, Ozone, Methane, Non-methane hydrocarbons and Inhalable Particulate(PM10) in the air. In addition to this wind direction, wind speed, temperature, humidity and solar radiation are also measured

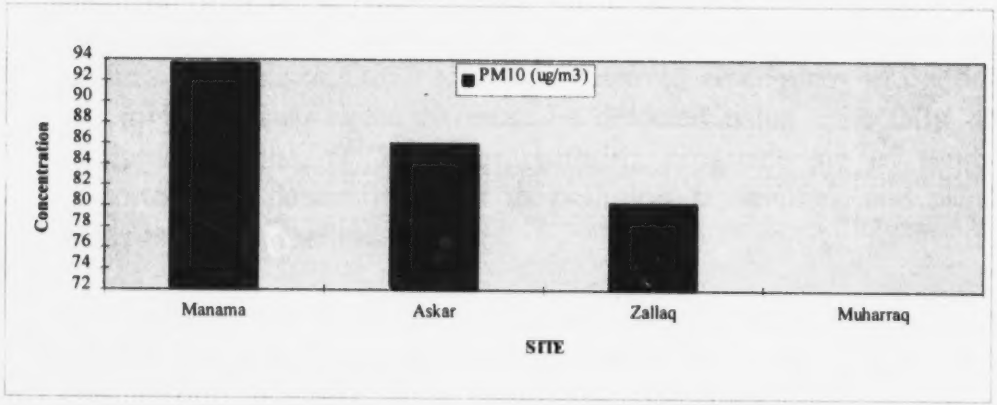
The ranges of parameter found during the monitoring period did not exceed the international Ambient Air Quality Standard (AAQS) with exception of ozone and particulate which occur during the dust episodes. However, the concentrations of the pollutants shows a little spatial variation across Bahrain. Table 3 and the following graphs presents the annual average of monitored parameters during 1996.

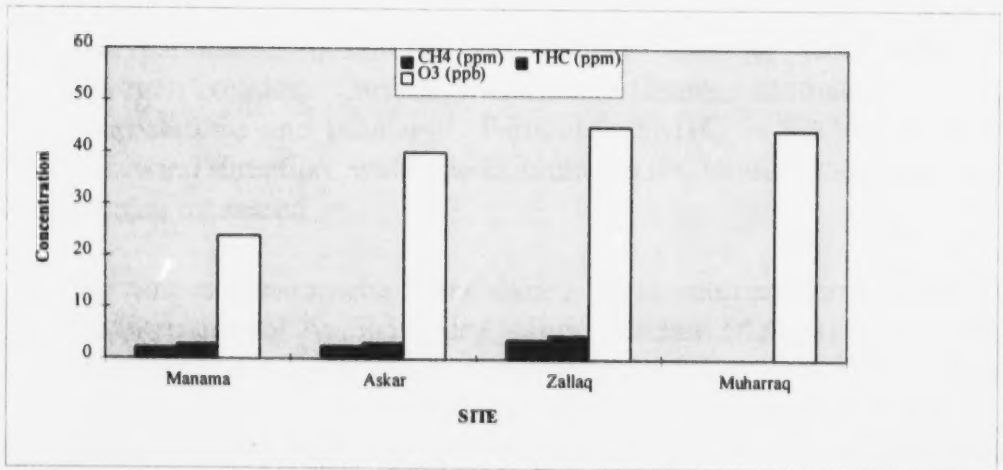
Table 3 Annual Average Concentration for 1996

	Manama	Askar	Zallaq	Muharraq
NO2 (ppb)	22.75	4.94	6.56	10
SO2 (ppb)	2.9	2.81	3.11	3.34
TRS (ppb)	2.08	1.44	2.05	2.56
CO (ppm)	2.16	0.74	0.93	1.15
PM10 (ug/	93.62	85.96	80.35	-
CH4 (ppm)	2.05	2.47	3.73	-
THC (ppm)	2.84	3.02	4.63	-
O3 (ppb)	23.77	40	44.95	44.43

Annual Average Concentration







Water Quality

Fresh Water Quality

Bahrain has no surface water resources, ground water is the only source of fresh water supply. During the past decade, the water supply of Bahrain has grown from least effective management to almost total management, from natural ground water to desalinated water and from a declining natural resource to a stabilizing and potentially improving situation. It is anticipated to be more effective after the Governments plan to re-use treated water is successfully implemented.

However, several sources of ground water pollution such as septic tanks and cesspools, deep well injection of oily water from oil fields and intrusion of sea-water have contributed to the deterioration of the quality of ground water.

Marine Water Quality

There are many factors affecting marine water quality. Urban centers along the coast, cause tremendous stress to the vulnerable coastal environment by discharging treated and untreated sewage into the shallow coastal waters, together with industrial effluents and irrigation drainage water.

Shortage of land for development has prompted Bahrain to reclaim more land from the sea by dredging . In the early years of reclamation and dredging activities, only low cost considerations were studied and environmental constraints were not given high priority. Unfortunately most of these reclamation activities has caused an increase in the turbidity of sea water, induced siltation and destroyed benthic communities of these areas. This dredging and reclamation activity has to continue as part of developmental activities.

Land-based sources of Pollution

Waste water is generally classified as domestic or industrial origin. Domestic waste water is derived principally from residential, business and institutional uses. The domestic waste water of community tends to be uniform in character. Considerable variation is possible between individual communities, whereas, industrial waste water may be thought of as waste flow not originating from domestic sources.

Each waste water is unique. It generally reflects the raw material components, the intermediate products, the end products and by-products of a particular manufacturing or production process.

The major sources of coastal pollution in Bahrain are the domestic sewage and industrial effluents, discharged from urban, rural and industrial areas. The effluents are discharged into the marine environment through numerous outfall located along the coast. The quality of the effluent and their pollution strength vary from one area to another and from one outfall to another depending on the degree and type of treatment. However, most industrial effluents and the domestic sewerage outfalls are located along the east coast of Sitra extending about 10 km, which would cause immense stress to the vulnerable coastal environment and as a result, monitoring becomes essential.

The EA has initiated a monitoring program with an ultimate goal to establish sound management of effluent discharge into the marine environment. The following strategies were adopted to achieve the goal:-

- Establish a data base.

- Assess stress on the marine environment.

- Establish national standards on effluent discharge into the marine environment.

- Implement periodical monitoring and evaluation programs.

The impact on the marine environment of effluents from major industries were investigated and monitored since 1983. Thirty seven physical and chemical parameters were measured for each industrial effluent. The result obtained since 1983 showed that most of industrial effluents are within the acceptable limits in accordance with EA interim effluent guidelines as well as USEPA and Saudi Meteorology and Environmental Protection Administration (MEPA) effluent standards. Therefore, there is no major impact on overall marine environment.

The main guiding principle of the EA is to balance development objectives with environmental protection. Sustainable industrial development and protection and conservation of Bahrain's natural resources are the ultimate

goals. Industry is being asked to promote cleaner technology, minimize waste, install pollution control equipment, increase efficiency and recycling. New development projects are carefully analyzed by the EA and, where necessary, the developer is requested to submit environmental impact statements.

As a result of Government efforts and the EA policy to mitigate and minimize the stress and hazards to the environment, the discharge of untreated and insufficiently treated waste water into the sea has been reduced through the expansion of the sewerage system, the installation of treatment plants among large industries, environmentally oriented industries and the improvement of some treatment facilities in various plants.

Furthermore, EA, requested all industries through Ministry of Oil and Industry (MoOI) to perform self monitoring for their effluent and to report the result periodically to EA. This strategy is to ensure the involvement of all sectors in minimizing emission to the environment and hence conserve it. Whereas, the role of EA in this regard would be to collect random samples to ensure the quality and compliance with discharge guidelines of the analysis.

Effluent guidelines shall be mandatory to all existing plants discharging their effluent into the marine environment, this would ensure that the high potential hazardous chemicals are not being discharged to the marine environment. Moreover, EA and MoOI have realized the importance of incorporating the EIA process for new industries, whereby both parties have signed "A memorandum of Understanding" which gives a flexible system in fulfilling the objectives of both parties taking into their accounts promoting the industrial investment and have a sustainable development. This has been re-stated in the Amiri decree-law No. 21 (1996), where the industry and the development -in general- shall get the approval and the consent of EA, before the start of the project. The EA has prepared the EIA procedures for development projects and will be ordered by H.E. the Minister.

On the regional scale, an attempt has been made to describe the kind of pollutants expected from industrial activities, the danger posed to the marine environment and to human health by pollution from land-based sources and the serious problem resulting in coastal waters of many regional states, principally due to the release of untreated, insufficiently

treated and for inadequately disposed of domestic or industrial discharge. Noting that the existing measures to prevent, abate and combat pollution caused by discharge from these activities were not available, a protocol has been signed by all countries in 1990, and ratified by Bahrain in April 1990 entitled " protocol from the protection of the marine environment against pollution from land based sources. Accordingly, all member states are obliged to report periodically, their effluent analysis to the ROPME. This ultimately shall lead into sound management with control on all land-based effluent discharge into the marine environment.

WILDLIFE

State of Flora and Fauna in Bahrain:

Vegetation cover most of the island, with over 200 species of flora so far identified, although the southern areas are certainly less well covered than the others. The northern and western coastal areas are heavily cultivated with data palm and alfalfa plantations and have been so for thousands of years. Artificial irrigation channels for the plantations have created a more diverse habitat, although the salinity of the irrigation water and very poor soil drainage restricts the diversity of the plant life to some extent. Typical of arid or semi-arid climates, the soils are known as pedocals. Water amounts are not sufficient to allow complete leaching, so sulfate and calcium carbonate (soluble salts) are found as a distinct layer in the profile of the soil. The vegetation of the non-irrigated areas is made up of typical desert plants, in the main comprised of four different types, each with its own adaptation to survive in a desert environment. These are:

Halophytes	-	high salinity tolerance
Xerophytes	-	tolerance to drought conditions.
Phreatophytes	-	utilizing underlying water-table.

Ephemerals opportunistic plants that capitalize on infrequent favorable conditions by a very short life cycle and bypass extended adverse conditions by producing seeds that are able to lie dormant for many years, awaiting rain.
However, all plants of arid and semi-arid regions can loosely and simply be termed Xerophytes.

Although fifty species of mammal occur on the mainland of Arabia, Bahrain can only boast thirteen terrestrial species confirmed as extant on the island.

Only 26 avian species actually breed on the archipelago, but over 265 different species of birds have been recorded in recent years. This is a very high figure for such a small desert type of island and shows the attractiveness of the habitats for migrating birds. The coastal areas, extensive plantations, desert habitats and smaller islands attract enormous numbers of birds on their spring and autumn migration routes, which pass close by Bahrain. Between central Eurasia and Africa an estimated 2-3 thousand million birds are thought to pass through the Gulf during their migration.

It is difficult to estimate correctly the number of species of reptile and amphibian occurring on Bahrain, but Gallagher established a definite 25 species and another 12 possibles. This is quite a variety for a small island if one considers an island such as the United Kingdom which can only boast twelve species.

The butterflies of Bahrain have been revised by (Torben & Harsen 1990). They listed about 21 species. They attributed this low species diversity to the harsh climate (high temperatures) that affects the adaptive behavior of butterflies.[2]

The results of most recent study on the benthic marine algae have indicated that there are 88 marine algae species in Bahrain and these are distributed as 21 chlorophyta, 17 phaeophyta, 13 cyanophyta and 37 rhodophyta. (Basson & Mohammed 1990). The authors reasoned the low number of reported species to the environmental stress setup by high salinity 43-80 ppt and high water temperature 36^{o} C featuring Bahrain's marine environment.

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2 Source: An Introduction to the Wildlife of Bahrain by Dr. Mike Hill & Dr. Paul Webb.

Protected areas for Wildlife:

1. Al-Areen Wildlife Park

This Park perhaps the first project in the region oriented to pressure the natural heritage of the Arabian countries.

Many species from Arabia and Africa have been introduced successfully to the park. Breeding programs have been undertaken and good results were produced particularly to those endangered and rare species.

Species of particular interest are: several species of gazelles, Arabian that Northern bald ibis, oryx, Arabian bustard, Dalmatian pelican and others. Also several species have just recently been introduced of which are Arabian wolf, Syrian wild ass, Arabian leopard (Samour, 1990).

2. Ras Sanad Mangrove Reserve.

The Environmental Affairs (EA) was given a 4 sq. Km of mangrove swamp to protect and develop to a reserve. The EA has demarcated the area and fencing the reserve will be undertaken in near future. Also, there is a plan to construct a bird watch tower and educational CENTER on the reserve which will publicize the importance of the reserve as nursery grounds to many fisheries such as shrimp and fishes. The Cabinet of Ministers on the session No. 1341 on 16th April 1995 and A Ministerial order No. 1 (1995) issued on 13th June 1995, further declare full protection for the mengal and ban coastal infilling.

3. Protection of Hawar Islands and the adjacent Territorial Waters.

The process of formal designation of protected areas such as the Hawar islands and the adjacent waters is now proceeding through the Prime Ministerial Edict No.16 (1996) and the Ministerial Order No.6 (1996) under the auspices of the Ministry of Housing, Municipalities and Environment (Environmental Affairs). An adhoc committee has been formed and chaired by Director General of EA, and comprising of members representing National Wildlife Committee, Arabian Gulf University, University of Bahrain, Bahrain Natural History Society, Directorate of Fisheries, Directorate of Tourism, and the Coast Guard.

Three subcommittees were formed;

a- Literature search and monitoring
b- Demarcation of boundaries
c- Environmental Public Awareness

The terms of reference of each sub-committee has been discussed and agreed upon and the final plan of action is under preparation.

Solid Waste

The domestic waste problem become a big issue at both levels, national and regional. It become apparent that regional coordination is required to utilize the best available technology on recycling, separation, compost and residual incineration of domestic waste. The concept of recycling still green and investors yet reluctant to invest in this line of business. The limited incineration and separation facilities in the region are neither sufficient nor efficient.

Generally speaking, there is a need to change the consumption pattern and habits in the region. The composition of average waste contain more than 50% food (left over), 4-10% papers, plastics, food and drinks package, about 0.6 - 4% cans and glass(Table 2).

Due to the absence of appropriate facilities for recycling, handling, separation and treatment of the domestic waste, the landfill process is the major method in use so far. There is no sound control to this dumping activity. However, the Municipalities Affairs is studying seriously the installation of facilities that would separate, incinerate and/or reduce waste size. There is an effort to encourage the private sector to invest in recycling business and at the same time plans to encourage public to sort their garbage at home, schools, offices, etc.

At the level of GCC there are some efforts to promote the concept of recycling for some domestic wastes such as aluminum cans, glass bottles, plastic containers, paper, etc. and at the same time encourage to use their substitutes - or reduce and economize in their usage or consumption.

The quantity of waste generated by the industries is large (Table 2), when compared with the site capacity, means of handling and facilities available.

No waste classified under Basel Convention's annexes are exported from Bahrain that would violate the articles of the convention. The secretariat of

the convention is kept informed on the steps undertaken toward the implementation of the articles.

Annex-I: List of projects for 1997 of the Directorate of Assessment and Planning.

Serial	Projects
1	Adoption of Standards
2	Reviewing the Convention on Biodiversity
3	Survey of Environmental Problems
4	Tubli Bay Monitoring (Mangrove protected area)
5	Marine Habitat Survey by remote sensing
6	EIA mechanism Inter and intraministerial Coordination
7	EIA Sectoral forms
8	Assessing of the Economic importance of the Marine Environment
9	Creation of GIS maps and data base for Tubli Bay Environment
10	Creation of GIS maps and data base on Howar Environment
11	Development of Environmental data bank
12	Setting Criteria for An Environmental Prize
13	Workshop on Environmental Economics
14	Issuance of Executive newsletter
15	Mechanism and Specification for Land Reclamation
16	Workshop on Environmental Management
17	Correlation of Environmental data and Health
18	Reporting on the control of NO_X from R. Power station
19	Mercure project Management
20	Industrial pollution control reporting guidelines
21	Environmental charges: Procedure and Directive
22	Hawar protection procedure
23	Coordination with UNDP
24	Coordination with Fisheries Directorate
25	Preparation of Environment and Development Report
26	GCC coordination and Ministerial Mtg.
27	Hidd Power Plant EIA
28	Hidd industrial area reclamation EIA
29	Manama - Muharraq 3rd crossing EIA
30	Ispat sponge iron plant EIA
31	Enabling Activity on Climate Change
32	Celebrating Environmental Days

Annex-II: List of projects for 1997 of the Directorate of Assessment and Planning.

Serial	Projects
1	Establish procedures to control traffic pollution
2	Study existing pollution problems generated by small and medium industries
3	Determine buffer zones for services
4	Develop a strategy to control asbestos
5	Develop standards for environmental pollutants and stresses
6	Implementation of Ozone strategy
7	Develop a laboratory performance strategy
8	Develop standards for wastes handling
9	Conduct a feasibility study for landfill site selection for industrial waste
10	Review of environmental laws and preparation of ministerial orders
11	Categorize the types of violation and appropriate measures to be enforced

Annex-III: BAHRAIN INTERIM EFFLUENT GUIDELINES

		MAXIMM	AVERAGE
PARAMETERS	UNITS		
PHYSICAL PROPERTIES			
Floating Particles	mg/m2	0	NIL
pH	pH	9	6 to 9
Temperature	C	CASE BY CASE	
Total suspended solids	mg/L	35.000	20.000
Turbidity (NTU)	N.T.U.	75.000	25.000
INORGANIC CHEMICAL PROPERTIES			
Ammonical Nitrogen as N	mg/L	3.000	1.000
Dissolved Oxygen	mg/L	>2	
Sulfide as H_2S	mg/L	1.000	0.500
Chlorine residual	mg/L	2.000	0.500
Cyanide as CN	mg/L	0.100	0.050
Chloride (Cl^-)	mg/L	TO BE REPORTED	
Nitrate (NO_3^-)-N-	mg/L	10.000	
Nitrite (NO_2^-)-N-	mg/L	1.000	
Phosphorous - Total	mg/L	2.000	1.000
M.B.A.S	mg/l	1.000	0.500
Fluoride (F^-)	mg/L	25.000	15.000
ORGANIC POLLUTANTS			
Biological Oxygen Demand	mg/L	50.000	25.000
Chemical Oxygen Demand	mg/L	350.000	150.000
Total Kjeldahl Nitrogen	mg/L	10.000	5.000
Hydrocarbons(FLUOR or IR)	mg/L	0.100	0.100
Oil & Grease (Hexane ex.)	mg/L	15.000	8.000
Phenols	mg/L	1.000	0.500
TRACE METALS			
Aluminium	mg/L	25.000	15.000
Arsenic	mg/L	0.500	0.100
Cadmium	mg/L	0.050	0.010
Chromium Total	mg/L	1.000	0.100

Copper	mg/L	0.500	0.200
Iron	mg/L	10.000	5.000
Lead	mg/L	1.000	0.200
Mercury	mg/L	0.005	0.001
Nickel	mg/L	0.500	0.200
Selenium	mg/L	1.000	0.200
Silver	mg/L	0.005	
Zinc	mg/L	5.000	2.000
Total Coliforms	No/100 ml	10000.000	1000.000